

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

1. (Currently Amended) A method for determining noise in radiography comprising:

acquiring at least two images, $i-1$ and i , of a same zone;

coding the acquired images into digital images that can be identified with matrices having horizontal by vertical dimensions equal to $N \times M$, each digital image being then formed by $N.M$ dots, each dot of an image i being identifiable by its coordinates $0 < x < N$, and $0 < y < M$, this dot then being referred to as a dot $P_i(x,y)$, each dot $P_i(x,y)$ then having a corresponding value v which is a result of the acquisition of the image, the value v having a dynamic range from V_{min} to V_{max} ;

dividing the dynamic range $V_{max} - V_{min}$ into sub-groups defined by a lower limit B_i and an upper limit B_s , the sub-groups having a null intersection, a joining of the sub-groups covering the dynamic range $V_{max} - V_{min}$, a dot of an image i then belonging to a given sub-group when $B_i \leq P_i(x,y) < B_s$, where $P_i(x,y)$ is the gray level of the pixel of the image i with coordinates (x,y) ;

computing, for at least one sub-group SG , of the standard deviation σ of the values $P_i(x,y) - P_{i-1}(x,y)$;

discriminating the values $P_i(x,y)$ of SG to keep only those values such that the criterion $C : P_i(x,y) - P_{i-1}(x,y) < \mu(P_i(x,y) - P_{i-1}(x,y)) + k.\sigma$, is met and thus, a sub-group SG' is obtained, where μ is a mean value;

applying the same computing and discriminating processing operations to the sub-group SG' as to the sub-group SG by iteration until a sub-group SG'', corresponding to an end-of-iteration criterion, is obtained;

performing iterative processing operations on all the sub-groups defined in the dynamic range $V_{\max} - V_{\min}$ and thus, for each sub-group, a standard deviation, associated with an x-axis value $v = (B_i + B_s)/2$, is obtained; [[and]]

performing an operation of regression on the dots obtained at the previous step to determine the coefficients α , β and γ of a noise function: $\sigma(v) = \alpha\sqrt{v} + \beta.v + \gamma$ defining the noise for a given value v [[.]]; and

producing an image in which noise has been reduced based upon the noise function.

2. (Previously presented) The method according to claim 1 wherein, before the regression and after the discrimination, the method eliminates, for the remainder of the processing, non-centered sub-groups, that is, the sub-groups such that the mean of the sub-group is greater than 1 times the standard deviation.

3. (Previously presented) The method according to claim 2 wherein the noise function is applied to the image i to reduce the noise in this image.

4. (Previously presented) The method according to claim 1 wherein the noise function is applied to the image i to reduce the noise in this image.

5. (Original) The method according to claim 1 wherein k is a non-null number.

6. (Original) The method according to claim 2 wherein k is a non-null number.

7. (Original) The method according to claim 3 wherein k is a non-null number.

8. (Original) The method according to claim 1 wherein the end-of-iteration criterion is a number of iterations greater than 5.

9. (Original) The method according to claim 2 wherein the end-of-iteration criterion is a number of iterations greater than 5.

10. (Original) The method according to claim 3 wherein the end-of-iteration criterion is a number of iterations greater than 5.

11. (Original) The method according to claim 5 wherein the end-of-iteration criterion is a number of iterations greater than 5.

12. (Original) The method according to claim 1 wherein the end-of-iteration criterion is the fact that all the dots of SG' meet the criterion C.

13. (Original) The method according to claim 2 wherein the end-of-iteration criterion is the fact that all the dots of SG' meet the criterion C.

14. (Original) The method according to claim 3 wherein the end-of-iteration criterion is the fact that all the dots of SG' meet the criterion C.

15. (Original) The method according to claim 5 wherein the end-of-iteration criterion is the fact that all the dots of SG' meet the criterion C.

16. (Original) The method according to claim 8 wherein the end-of-iteration criterion is the fact that all the dots of SG' meet the criterion C.

17. (Previously presented) The method according to claim 1 wherein:

during a first regression, first coefficients α , β and γ are obtained;

determining a first curve that separates the sub-groups into two, those whose standard deviation is above the first curve and those whose standard deviation is below the first curve;

a weighting P of less than 1 is applied to the standard deviation of the sub-groups whose standard deviation is located above the first curve;

a second regression is performed from the weighted sub-groups to obtain second coefficients α' , β' and γ' determining a new noise curve; and

from the new curve, the same computing and discriminating processing operations are carried out as those performed from the first curve, iteratively, for a number of times equal to R.

18. (Previously presented) The method according to claim 2 wherein:

during a first regression, first coefficients α , β and γ are obtained;

determining a first curve that separates the sub-groups into two, those whose standard deviation is above the first curve and those whose standard deviation is below the first curve;

a weighting P of less than 1 is applied to the standard deviation of the sub-groups whose standard deviation is located above the first curve;

a second regression is performed from the weighted sub-groups to obtain second coefficients α' , β' and γ' determining a new noise curve; and

from the new curve, the same computing and discriminating processing operations are carried out as those performed from the first curve, iteratively, for a number of times equal to R.

19. (Previously presented) The method according to claim 3 wherein:

during a first regression, first coefficients α , β and γ are obtained;

determining a first curve that separates the sub-groups into two, those whose standard deviation is above the first curve and those whose standard deviation is below the first curve;

a weighting P of less than 1 is applied to the standard deviation of the sub-groups whose standard deviation is located above the first curve;

a second regression is performed from the weighted sub-groups to obtain second coefficients α' , β' and γ' determining a new noise curve; and

from the new curve, the same computing and discriminating processing operations are carried out as those performed from the first curve, iteratively, for a number of times equal to R.

20. (Previously presented) The method according to claim 4 wherein:
- during a first regression, first coefficients α , β and γ are obtained;
 - determining a first curve that separates the sub-groups into two, those whose standard deviation is above the first curve and those whose standard deviation is below the first curve;
 - a weighting P of less than 1 is applied to the standard deviation of the sub-groups whose standard deviation is located above the first curve;
 - a second regression is performed from the weighted sub-groups to obtain second coefficients α' , β' and γ' determining a new noise curve; and
 - from the new curve, the same computing and discriminating processing operations are carried out as those performed from the first curve, iteratively, for a number of times equal to R.

21. (Previously presented) The method according to claim 8 wherein:
- during a first regression, first coefficients α , β and γ are obtained;
 - determining a first curve that separates the sub-groups into two, those whose standard deviation is above the first curve and those whose standard deviation is below the first curve;
 - a weighting P of less than 1 is applied to the standard deviation of the sub-groups whose standard deviation is located above the first curve;
 - a second regression is performed from the weighted sub-groups to obtain second coefficients α' , β' and γ' determining a new noise curve; and
 - from the new curve, the same computing and discriminating processing operations are carried out as those performed from the first curve, iteratively, for a number of times equal to R.

22. (Previously presented) The method according to claim 12 wherein:
- during a first regression, first coefficients α , β and γ are obtained;
- determining a first curve that separates the sub-groups into two, those whose standard deviation is above the first curve and those whose standard deviation is below the first curve;
- a weighting P of less than 1 is applied to the standard deviation of the sub-groups whose standard deviation is located above the first curve;
- a second regression is performed from the weighted sub-groups to obtain second coefficients α' , β' and γ' determining a new noise curve; and
- from the new curve, the same computing and discriminating processing operations are carried out as those performed from the first curve, iteratively, for a number of times equal to R.
23. (Original) The method according to claim 17 wherein P is in the interval [0,75 ... 0,99].
24. (Original) The method according to claim 18 wherein P is in the interval [0,75 ... 0,99].
25. (Original) The method according to claim 19 wherein P is in the interval [0,75 ... 0,99].
26. (Original) The method according to claim 20 wherein P is in the interval [0,75 ... 0,99].
27. (Original) The method according to claim 21 wherein P is in the interval [0,75 ... 0,99].

28. (Original) The method according to claim 22 wherein P is in the interval [0,75 ... 0,99].

29. (Original) The method according to claim 23 wherein P is in the interval [0,75 ... 0,99].

30. (Original) The method according to claim 17 wherein P is in the interval [0 ... 0,75].

31. (Original) The method according to claim 18 wherein P is in the interval [0 ... 0,75].

32. (Original) The method according to claim 19 wherein P is in the interval [0 ... 0,75].

33. (Original) The method according to claim 20 wherein P is in the interval [0 ... 0,75].

34. (Original) The method according to claim 21 wherein P is in the interval [0 ... 0,75].

35. (Original) The method according to claim 22 wherein P is in the interval [0 ... 0,75].

36. (Original) The method according to claim 23 wherein P is in the interval [0 ... 0,75].

37. (Original) The method according to claim 17 wherein R is in the interval [3 ... 10].

38. (Original) The method according to claim 18 wherein R is in the interval [3 ... 10].

39. (Original) The method according to claim 19 wherein R is in the interval [3 ... 10].

40. (Original) The method according to claim 20 wherein R is in the interval [3 ... 10].

41. (Original) The method according to claim 21 wherein R is in the interval [3 ... 10].

42. (Original) The method according to claim 22 wherein R is in the interval [3 ... 10].

43. (Original) The method according to claim 23 wherein R is in the interval [3 ... 10].

44. (Original) The method according to claims 17 wherein R is greater than 10.

45. (Original) The method according to claims 18 wherein R is greater than 10.

46. (Original) The method according to claims 19 wherein R is greater than 10.

47. (Original) The method according to claims 20 wherein R is greater than 10.

48. (Original) The method according to claims 21 wherein R is greater than 10.

49. (Original) The method according to claims 22 wherein R is greater than 10.

50. (Original) The method according to claims 23 wherein R is greater than
10.

51. (Cancelled)

52. (Currently amended) A computer program product comprising a computer useable medium having computer readable program code means embodied in the medium, the computer readable program code means executable by a computer for implementing steps of a method, ~~wherein the computer readable program code means comprises~~ comprising:

~~computer readable program code means embodied in a medium for causing a computer to provide for~~ acquiring at least two images, $i-1$ and i , of a same zone;

~~computer readable program code means embodied in a medium for causing a computer to provide for~~ coding the acquired images into digital images that can be identified with matrices having horizontal by vertical dimensions equal to $N \times M$, each digital image being then formed by $N.M$ dots, each dot of an image i being identifiable by its coordinates $0 < x < N$, and $0 < y < M$, this dot then being referred to as a dot $P_i(x,y)$, each dot $P_i(x,y)$ then having a corresponding value v which is the result of the acquisition of the image, the value v having a dynamic range from V_{min} to V_{max} ;

~~computer readable program code means embodied in a medium for causing a computer to provide for~~ dividing the dynamic range $V_{max} - V_{min}$ into sub-groups defined by a lower limit B_i and an upper limit B_s , the sub-groups having a null intersection, the joining of the sub-groups covering the dynamic range $V_{max} - V_{min}$, a dot of an image i then belonging to a given sub-group when $B_i \leq P_i(x,y) < B_s$, where $P_i(x,y)$ is the gray level of the pixel of the image i with coordinates (x,y) ;

~~computer readable program code means embodied in a medium for causing a computer to provide for~~ computing, for at least one sub-group SG, of the standard deviation σ of the values $P_i(x,y) - P_{i-1}(x,y)$;

~~computer readable program code means embodied in a medium for causing a computer to provide for~~ discriminating the values $P_i(x,y)$ of SG to keep only those values such that the criterion $C : P_i(x,y) - P_{i-1}(x,y) < \mu(P_i(x,y) - P_{i-1}(x,y)) + k.\sigma$, is met and thus, a sub-group SG' is obtained, where μ is a mean value;

~~computer readable program code means embodied in a medium for causing a computer to provide for~~ applying the same computing and discriminating processing operations to the sub-group SG' as to the sub-group SG by iteration until a sub-group SG'', corresponding to an end-of-iteration criterion, is obtained;

~~computer readable program code means embodied in a medium for causing a computer to provide for~~ performing iterative processing operations on all the sub-groups defined in the dynamic range $V_{max} - V_{min}$ and thus, for each sub-group, a standard deviation, associated with an x-axis value $v = (B_i + B_s)/2$, is obtained; [[and]]

~~computer readable program code means embodied in a medium for causing a computer to provide for~~ performing an operation of regression on the dots obtained at the previous step to determine the coefficients α , β and γ of the noise function: $\sigma(v) = \alpha.\sqrt{v} + \beta.v + \gamma$ defining the noise for a given value $v[[.]]$; and

producing an image in which noise has been reduced based upon the noise function.

53. (Currently Amended) An article of manufacture for use with a computer system, the article of manufacture comprising a computer readable medium having computer readable program code means embodied in the medium, the program code means implementing steps of a method, the program code means comprising:

computer readable program code means embodied in a medium for causing a computer to provide for acquiring at least two images, $i-1$ and i , of a same zone;

computer readable program code means embodied in a medium for causing a computer to provide for coding the acquired images into digital images that can be identified with matrices having horizontal by vertical dimensions equal to $N \times M$, each digital image being then formed by $N.M$ dots, each dot of an image i being identifiable by its coordinates $0 < x < N$, and $0 < y < M$, this dot then being referred to as a dot $P_i(x,y)$, each dot $P_i(x,y)$ then having a corresponding value v which is the result of the acquisition of the image, the value v having a dynamic range from V_{min} to V_{max} ;

computer readable program code means embodied in a medium for causing a computer to provide for dividing the dynamic range $V_{max} - V_{min}$ into sub-groups defined by a lower limit B_i and an upper limit B_s , the sub-groups having a null intersection, the joining of the sub-groups covering the dynamic range $V_{max} - V_{min}$, a dot of an image i then belonging to a given sub-group when $B_i \leq P_i(x,y) < B_s$, where $P_i(x,y)$ is the gray level of the pixel of the image i with coordinates (x,y) ;

computer readable program code means embodied in a medium for causing a computer to provide for computing, for at least one sub-group SG , of the standard deviation σ of the values $P_i(x,y) - P_{i-1}(x,y)$;

computer readable program code means embodied in a medium for causing a computer to provide for discriminating the values $P_i(x,y)$ of SG to keep only those values such that the criterion $C : P_i(x,y) - P_{i-1}(x,y) < \mu(P_i(x,y) - P_{i-1}(x,y)) + k.\sigma$, is met and thus, a sub-group SG' is obtained, where μ is a mean value;

computer readable program code means embodied in a medium for causing a computer to provide for applying the same computing and discriminating processing operations to the sub-group SG' as to the sub-group SG by iteration until a sub-group SG'', corresponding to an end-of-iteration criterion, is obtained;

computer readable program code means embodied in a medium for causing a computer to provide for performing iterative processing operations on all the sub-groups defined in the dynamic range $V_{\max} - V_{\min}$ and thus, for each sub-group, a standard deviation, associated with an x-axis value $v = (B_i + B_s)/2$, is obtained; [[and]]

computer readable program code means embodied in a medium for causing a computer to provide for performing an operation of regression on the dots obtained at the previous step to determine the coefficients α , β and γ of the noise function: $\sigma(v) = \alpha\sqrt{v} + \beta.v + \gamma$ defining the noise for a given value v [[.]]; and

computer readable program code means embodied in a medium for causing a computer to provide for producing an image in which noise has been reduced based upon the noise function.

54. (Currently Amended) A program storage device readable by a ~~machine~~ computer tangibly embodying a program of instructions executable by the ~~machine~~ computer to perform steps of a method comprising:

~~the program of instructions embodied in a medium for causing the machine to provide for~~ acquiring at least two images, $i-1$ and i , of a same zone;

~~the program of instructions embodied in a medium for causing the machine to provide for~~ coding the acquired images into digital images that can be identified with matrices having horizontal by vertical dimensions equal to $N \times M$, each digital image being then formed by $N.M$ dots, each dot of an image i being identifiable by its coordinates $0 < x < N$, and $0 < y < M$, this dot then being referred to as a dot $P_i(x,y)$, each dot $P_i(x,y)$ then having a corresponding value v which is the result of the acquisition of the image, the value v having a dynamic range from V_{min} to V_{max} ;

~~the program of instructions embodied in a medium for causing the machine to provide for~~ dividing the dynamic range $V_{max} - V_{min}$ into sub-groups defined by a lower limit B_i and an upper limit B_s , the sub-groups having a null intersection, the joining of the sub-groups covering the dynamic range $V_{max} - V_{min}$, a dot of an image i then belonging to a given sub-group when $B_i \leq P_i(x,y) < B_s$, where $P_i(x,y)$ is the gray level of the pixel of the image i with coordinates (x,y) ;

~~the program of instructions embodied in a medium for causing the machine to provide for~~ computing, for at least one sub-group SG, of the standard deviation σ of the values $P_i(x,y) - P_{i-1}(x,y)$;

~~the program of instructions embodied in a medium for causing the machine to provide for~~ discriminating the values $P_i(x,y)$ of SG to keep only those values such that the

criterion C : $P_i(x,y) - P_{i-1}(x,y) < \mu(P_i(x,y) - P_{i-1}(x,y)) + k.\sigma$, is met and thus, a sub-group SG' is obtained, where μ is a mean value;

~~the program of instructions embodied in a medium for causing the machine to provide for~~ applying the same computing and discriminating processing operations to the sub-group SG' as to the sub-group SG by iteration until a sub-group SG'', corresponding to an end-of-iteration criterion, is obtained;

~~the program of instructions embodied in a medium for causing the machine to provide for~~ performing iterative processing operations on all the sub-groups defined in the dynamic range $V_{\max} - V_{\min}$ and thus, for each sub-group, a standard deviation, associated with an x-axis value $v = (B_i + B_s)/2$, is obtained; [[and]]

~~the program of instructions embodied in a medium for causing the machine to provide for~~ performing an operation of regression on the dots obtained at the previous step to determine the coefficients α , β and γ of the noise function: $\sigma(v) = \alpha.\sqrt{v} + \beta.v + \gamma$ defining the noise for a given value v [[.]]and

producing an image in which noise has been reduced based upon the noise function.

55. (New) The method of Claim 1, further comprising:

acquiring images via determining and emitting a dose of radiation based upon the noise function.